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THE INFLUENCE OF ATHLETIC TRAINING UPON BASAL METABOLISM

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Two fundamental conceptions exist with regard to the heat production of the body. One is that the heat production is proportional to the active mass of protoplasmic tissue; the other, and more generally accepted view, is that the heat production is proportional to the surface area of the body. To throw light upon this question we have made an investigation upon the metabolism of a number of trained college athletes in whom the proportion of active protoplasmic tissue would undoubtedly be greater than that in the body of a normal, untrained individual. In considering the results of this study, the differences in surface area have been eliminated by making the comparisons only between groups of individuals with like height and weight.

Fifteen athletes, varying in weight from 88.5 kg. to 56.3 kg., were studied by means of the universal respiration apparatus, the subjects being in a condition of complete muscular repose and in the post absorptive state, i.e., at least 12 hours after the last meal. Only the average values of several closely agreeing tests with each subject are used in the comparisons. From an extended series of metabolism experiments on normal individuals a sufficient number of suitable non-athletes of similar height and weight are selected for a series of comparisons which are made in ten groups. Of these ten groups the first four are given in the table herewith, thus serving to indicate the method of comparison as well as the actual values found in the four groups. In the complete comparison we found that in the ten groups the heat production per kilogram of body weight was greatest with the athletes in all but two groups, and in these two there was no difference between the athletes and non-athletes. The heat production per kilogram per 24 hours averaged for the athletes 26.0 calories and for the comparable non-athletes, 24.4 calories.

Per square meter of body surface the athletes again exceeded the metabolism of the non-athletes in all groups with but slight increases in 3 groups. The average heat production per square meter per 24 hours was 863 calories with the athletes and 807 calories with the non-athletes.

In general there was a distinct tendency for the athletes to have a measurably larger basal resting metabolism (about 7%) than the non-

COMPARISON OF THE HEAT PRODUCTION OF ATHLETES AND NORMAL NON-ATHLETIC MEN.

Group and subject	Nude weight kilos	Height cms.	HEAT PRODUCTION PER 24 HOURS (computed)				
			Total cals.	Per kilogram cals.	Per square meter cals.		
Group I							
Athlete							
W. S.....	88.5	165	2017	22.8	823		
Non-athlete							
O. F. M.....	85.8	171	1827	21.3	761		
Group II							
Athletes							
J. H. R.....	82.2	187	1978	24.1	849		
D. H. W.....	82.1	186	2034	24.8	873		
M. H. K.....	79.0	188	1944	24.6	856		
E. G.....	78.9	184	2126	27.0	940		
Non-athletes							
F. G. B.....	83.1	183	1802	21.7	770		
W. A. M.....	78.0	183	1816	23.3	807		
Group III							
Athlete							
F. G. R.....	74.0	179	1914	25.9	882		
Non-athletes							
W. J. T.....	74.2	183	1770	23.9	816		
C. B. S.....	71.1	179	1700	23.9	806		
Group IV							
Athletes							
C. D. R.....	74.0	173	1908	25.8	879		
H. R. W.....	73.9	175	1842	24.9	848		
Non-athletes							
Dr. M.....	75.9	175	1877	24.7	849		
J. P. C.....	73.7	169	1526	20.7	706		
H. W. E.....	73.0	168	1559	21.4	725		

athletes with whom they were compared. Since in these comparisons we considered only individuals of similar height and weight, it is clear that these differences were not due to changes in body surface, but from what is known with regard to athletic training we may maintain that the increased katabolism is directly due to the larger proportion of active protoplasmic tissue in the body of the athletes, thus suggesting that the katabolism of the body is proportional not to the surface area, but to the mass of active protoplasmic tissue.

The detailed report of the investigation has been transmitted to the *Journal of Biological Chemistry*.